

few miles south of the city, demolishing buildings and fences and uprooting trees. At Paoli and Princeton, Ind., 14th, a. m., a heavy "tornado" passed northeastward, unroofing houses and blowing down fences. Norwalk, Huron county, Ohio, 14th, about 11 a. m., a "terrible wind-storm or tornado" passed over the central portion of the county in a northeasterly direction, "tearing houses to pieces and scattering the contents in every direction; straw stacks, orchards, fences and barns were demolished, trees uprooted and animals killed." Louisville, Ky., 28th, 5:45 a. m., "a severe tornado swept over the southeastern portion of the city, marking its pathway by a broad track of demolished fences, uprooted trees and injured houses. The storm was a fearful one and passed directly from the southwest to the northeast. The cloud was an immense dark, whirling, tossing mass, which seemed to possess a wrenching, spiral motion, to which much of the damage was in all probability due. The wind was terrific, and carried every obstacle before it; coming at first in heavy gusts, it soon reached a steady hurricane-velocity." Greensburg, Ind., 28th, a. m., a heavy wind and rain-storm visited this place, blowing off roofs and tearing up trees. Madison, Ind., 28th, about 5 a. m., a heavy wind and rain-storm, accompanied with severe thunder and lightning passed over the city, causing considerable damage. Seymour, Ind., 28th, "about noon a dark and angry looking cloud rose in the west causing such intense darkness that it became necessary to light lamps. As it came up it rolled over and over making one revolution after another in quick succession. As it approached the town it rose and fell, sometimes coming below the tree-tops, shaving off every limb it came in contact with as if it had been done with an axe. When above the trees the sound of the wind resembled that of a mighty cataract. Its path was not over 200 yards wide and direction from southwest to northeast."

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather indications for November with the telegraphic reports for the succeeding twenty-four hours, shows the general per centage of omissions to be 0.03 per cent., and of verifications to be 90.8 per cent. The percentages for the four elements have been—weather, 94.0; direction of the wind, 88.9; temperature, 92.4; barometer, 87.8. The percentages of verification by geographical districts, have been: New England, 93.1; Middle States, 91.5; South Atlantic States, 90.6; Eastern Gulf States, 92.3; Western Gulf States, 88.7; Lower Lake region, 91.2; Upper Lake region, 92.4; Tennessee and the Ohio valley, 92.4; Upper Mississippi valley, 87.2; Lower Missouri valley, 87.6; Northern Pacific coast region, 95.0; Central Pacific coast region, 98.3; Southern Pacific coast region, 97.5. Of the 3,689 predictions that have been made, 95, or 2.58 per cent. are considered to have entirely failed; 92, or 2.49 per cent. were one-fourth verified; 268, or 7.26 per cent. were one-half verified; 159, or 4.31 per cent. were three-fourths verified; 3,075, or 83.36 per cent. were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary Signals.—236 Cautionary signals were displayed during the month, of which 219, or 92.8 per cent. were justified by winds of 25 miles per hour or over, at, or within a radius of 100 miles of the station. 82 Off-shore Signals were displayed, of which 80, or 97.6 per cent. were fully justified. Of the Cautionary Off-shore Signals 58 were changed from Cautionary. 260 of both kinds were displayed, of which 242, or 93.1 per cent. were fully justified. The above does not include 52 Signals ordered at display stations where the velocity is only estimated. Six signals were reported somewhat late; 67 cases were reported of winds of 25 miles or over where signals were not ordered.

NAVIGATION.

In the table on the right hand side of Chart No. III are given the highest and lowest readings of the Signal Service river gauges for the month, with the dates of the same. During the first half of the month the rivers in general continued quite low. From the 14th to the 25th higher readings were generally reported, but in no case did they approach near the danger-marks. The heavy rains previous to the 15th made a good navigable river in the Ohio at Pittsburgh for the first time since the early part of August. On the 18th low water on the Lower Fox river, Wis., compelled manufacturies to run short time.

Ice in Rivers and Harbors.—The mild weather prevalent throughout October and the first half of November delayed the formation of ice to such an extent as not to interfere with navigation, except on the Upper Missouri and Red river of the North, until the last few days of the present month. The following notes on the formation of ice are of interest: The *Missouri* was closed by ice at Fort Buford, Dak., on the 27th; at Ft. Stevenson, Dak., floating ice passed down the river on the 2nd, 3rd and 21st, and the river was closed by ice from the 23rd to the 28th; at Bismarck, Dak., river froze over on the 2nd, but ice broke up on the 4th, and on the 27th the river was closed by ice; at Ft. Randall, Dak., floating ice passed down on the 22nd; at Yankton, Dak., floating ice was observed during the entire month; on the 20th the ferry-boat was frozen in; on the 29th the channel was frozen over for eight hours and navigation closed; at Plattsmouth, Neb., floating ice passed down on the 3rd and 4th, and on the 20th and 21st—on the 22nd it gorged at the railroad pile-bridge, and on the 24th and 25th the gorge lifted out the piles and destroyed bridge—26th, river was free of ice, but on the 29th and 30th floating ice was again reported. The *James River* at Morristown, Dak., was frozen over on the 1st—on the 7th the ice had all disappeared, but by the 27th the river was again frozen over. *Red River of the North.*—At Pembina, on the 1st, large quantities of floating ice passed down, and on the 2nd the river froze over and navigation closed, but on the 6th the ice was fast breaking up; at Winnipeg, Manitoba, on the 3rd, an ice bridge had formed over the river and persons crossed on foot. *Mississippi.*—At St. Paul, Minn., on the 2nd and the 24th the river was partly frozen, on the 20th full of floating ice, and owing to the masses of

anchor ice in the canal the leading flour mills were compelled to close their gates; at La Crosse, Wis., on the 20th and 21st much floating ice; at Dubuque, Iowa, 22nd, shore ice, 23rd, river full of floating ice, "navigation suspended;" floating ice was also reported at Davenport, 25th to 30th, at Muscatine, 24th and at Burlington on the 29th. *Rock River* at Rockford, Ill., was covered with thin ice on the 4th; on the 21st it froze over and remained partly frozen until the 25th, on the 27th the ice had disappeared. The *Manitowoc* river at Manitowoc, Wis., was closed by ice on the 20th, and the *Embarrass* river at Embarrass, Wis., was frozen over on the 30th. The *Toledo* river was covered by thin ice the 24th and 26th at Toledo, Ohio; at Sandusky, 20th, ice formed along the docks and on the 24th and 25th considerable floating ice was observed in the bay. The *Monongahela* at Morgantown frozen over on the 24th but opened on the 26th. On the 21st and 22nd, quite an ice blockade formed in the Erie canal at Rome and Auburn, N. Y., but the ice was broken up on the 23rd; on the 26th there was considerable floating ice in the canal at Whitehall, N. Y., and a tow of nine barges was frozen in on the 28th. *Lake Champlain*, West Charlotte, Vt., ice formed along the lake shores on the 21st and 30th. *Ottawa River*.—On the 24th navigation was practically closed by ice at Ottawa, Ontario, and the *St. John River* at Fredericton, N. B., was frozen over. *St. Lawrence River*.—On the 22nd was frozen over from above the rapids down to the Grand Trunk Railroad bridge; on the 26th ice was forming in considerable quantities along the shores of the Lower St. Lawrence, and two schooners were reported frozen in at Kamouraska; and, same date, steamer Bellona, the last boat of season from Montreal to Liverpool, got fast in ice at Lake St. Peter, near Three Rivers, but afterward got out and proceeded on the 29th.

High Tides.—Eastport, 15th, 16th.

Low Tides.—Baltimore, 21st, unusually low; Portsmouth, N. C., 9th, 10th, 11th, 12th, 26th 27th, unusually low.

TEMPERATURE OF WATER.

The Temperatures of Water, as observed in rivers and harbors, with average depth at which the observations were taken, are given on Chart No. II. At the following stations no observations were made on the dates indicated: At Cedar Keys, Fla., observations were commenced on the 16th; at Cleveland, the Lake was too rough on the 3rd, 18th, 20th, 23rd, 25th, 28th and 29th, and on the 21st and 22nd the pier was covered with ice and snow; at Escanaba floating ice prevented observations being made during the last three days of month.

ATMOSPHERIC ELECTRICITY.

Thunder-storms were reported in the various districts, as follows: New England, on the 3rd, 6th, 7th, 12th, 13th, 14th, 19th, 20th, 22nd; Middle Atlantic States, 3rd, 11th, 12th, 14th, 15th, 19th, 23rd, 29th; South Atlantic States, 15th, 19th; Eastern Gulf States, 6th, 11th, 13th, 14th, 15th, 17th, 27th, 28th; Western Gulf States, 5th, 8th, 9th, 11th, 13th, 14th, 17th, 27th; Ohio valley and Tennessee, 2nd, 9th, 10th, 12th, 13th, 14th, 15th, 16th, 17th, 27th, 28th, 29th; Upper Lake region, 8th, 9th, 10th, 11th, 12th, 14th, 15th, 26th, 27th, 28th; Lower Lake region, 2nd, 9th, 12th, 14th, 15th, 23rd; Upper Mississippi valley, 8th, 10th, 11th, 12th, 13th, 14th, 16th, 17th, 18th, 21st, 24th, 26th, 27th, 28th; Lower Missouri valley, 8th, 10th, 11th, 13th, 14th, 16th, 26th, 27th, 28th; Middle Eastern Rocky Mountain Slope, 8th, 10th, 11th, 13th, 14th, 16th, 17th, 26th, 27th.

Auroras.—Cambridge, Mass., regularly looked for 8 p. m.; none seen during the month; decidedly cloudy on the 2nd, 3rd, 6th, 8th, 9th, 11th, 12th, 13th, 14th, 15th, 17th, 18th, 19th, 20th, 27th, 28th; some clouds, with moonlight, 22nd, 25th; moonlight, 1st, 21st, 23rd, 24th, 26th, 29th, 30th; if present, might have been seen 4th, 5th, 7th, 10th, 16th. Calistoga, Cal., 26th, 8:30 p. m., extended from WNW. to NNE.; diffuse yellow light; no streamers. Olivet, Dak., 6th, slight diffuse light. Augusta, Ill., 30th. Fort Wayne, Ind., 13th, 14th. Iowa City, Ia., 5th, 14th, 30th. Fall River, Mass., 1st. Vineland, N. J., 12th. Starkey, N. Y., 3rd, 13th, 21st. Ringgold, Ohio, 3rd, 10th. Milton, Pa., 15th, 5:30 p. m., two arches, colors dark, tinged with red; disappeared at 6 p. m. Bismarck, 11th, from 6 to 10 p. m., white nebulous light. Toledo, 1st, 10 p. m., single arch. Port Huron, 28th.

OPTICAL PHENOMENA.

Solar Halos were reported from the various districts on the following dates:—New England, on the 2nd, 10th, 11th, 21st, 22nd and 27th; Middle States, 2nd, 10th, 19th, 26th and 30th; South Atlantic States, 5th, 6th, 11th, 12th, 22nd, 28th and 29th; Lake Region and Ohio valley, 2nd, 7th, 8th, 10th, 15th, 16th, 21st, 22nd, 24th, 26th, 27th, 29th and 30th; Gulf States, 4th, and from the 23rd to the 27th; Northwest, 4th, 5th, 7th, 9th, 11th, 13th, 16th, 17th, 19th, 20th, 21st, 23rd, 25th, 26th, 27th and 30th; New Mexico, on the 3rd; Nevada, 6th and 25th; California, on the 1st and 2nd.

Lunar Halos were reported from the various districts on the following dates:—New England from the 22nd to the 29th, inclusive; Middle States, 1st and 2nd, and from the 20th to the 30th; South Atlantic States, 2nd, 3rd and 5th, and from the 21st to the 30th; Florida, 24th 25th and 29th; Alabama, 24th; Mississippi 5th and 24th; Southwest, 19th to 30th; Tennessee, 22nd to 26th and on the 30th; Ohio valley, 1st to 3rd, 22nd to 27th and on the 30th; Lower Lake region, 1st, 24th and 30th; Upper Lake region, 1st to 3rd, 21st, 24th, 25th and 29th; Northwest, 2nd to 5th, and from the 20th to the 30th; Colorado, 25th, 28th, 29th and 30th; New Mexico, 2nd, 28th and 29th; Nevada, 24th, 25th and 29th; Idaho, 4th, 19th and 23rd; California, 1st, 2nd, 27th, 29th and 30th.